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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/782,329

02/19/2004

Grant M. Kloster

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04/05/2005

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EXAMINER

SOWARD, IDA M

ART UNIT

PAPER NUMBER

2822

DATE MAILED: 04/05/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/782,329

Applicant(s)

KLOSTER ET AL.

Examiner

Ida M. Soward

Art Unit

2822

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 February 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 16-23 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 16-23 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 19 February 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

This Office Action is in response to the preliminary amendment filed February 19, 2004.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 16, 20 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fornof et al. (US 2003/0111263 A1) in view of Avanzino et al. (US 2003/0218253 A1).

In regard to claim 16, Fornof et al. teach a device comprising:

A semiconductor substrate 1 having at least one layer with conductive metal lines 13 thereon; and a dielectric material 5 & 9 between metal lines 13, the dielectric material 5 & 9 having a surface abutting a conductive metal line 13.

However, Fornof et al. fail to teach the conductive metal line having a smoother sidewall than the facing dielectric surface.

Avanzino et al. teach a conductive metal line 54 & 56 (page 4, paragraph [0051]) having a smoother sidewall than the facing dielectric 58 & 60 (Page 4, paragraph [0052]) surface (abstract and Figure 15).

Art Unit: 2822

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device structure as taught by Fornof et al. with the device having a conductive metal line having a smoother sidewall than the facing dielectric surface as taught by Avanzino et al. to improve techniques for integrating porous dielectric material with metal lines to avoid rough sidewalls (page 1, paragraph [0006]).

In regard to claim 20, Fornof et al. teach the dielectric material 5 & 9 having a dielectric constant of 2.2 (pages 2-3, paragraphs [0026] and [0028], respectively) which is in the range of below about 3.0.

In regard to claim 23, Fornof et al. teach the dielectric material 5 & 9 having a thermal stability of 425 degrees C (pages 2-3, paragraphs [0026] and [0028], respectively) which is in the range of greater than about 400 degrees C.

Claims 17-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fornof et al. (US 2003/0111263 A1) as applied to claims 16, 20 and 23 above, and further in view of Avanzino et al. (US 2003/0218253 A1).

Fornof et al. teach all mentioned in the rejection above.

However, Fornof et al. fail to teach the dielectric material being at least 50% porous; and the dielectric material being over a conductive layer.

In regard to claim 17, Figure 15 of Avanzino et al. teach a dielectric material 58 & 60 being at least 50% porous.

In regard to claim 18, Avanzino et al. teach a dielectric material 58 & 60 being over a conductive layer 24 (Figure 15, page 4, paragraph [0051]).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device structure as taught by Fornof et al. with the device having a dielectric material being at least 50% porous, and being over a conductive layer as taught by Avanzino et al. to provide a low resistivity wiring network (page 1, paragraph [0003]).

Claims 19 and 21-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fornof et al. (US 2003/0111263 A1) and Avanzino et al. (US 2003/0218253 A1) as applied to claims 1, 20 and 23 above, and further in view of Kumar et al. (US 6,436,810 B1).

Fornof et al. and Avanzino et al. teach all mentioned in the rejection above.

However, Fornof et al. and Avanzino et al. fail to teach the dielectric material comprising a carbon-doped oxide, a fluorinated silica glass or a silsesquioxane-based material.

In regard to claim 19, Kumar et al. teach a dielectric material comprising a carbon-doped oxide (Figure 20, column 5, lines 12-17).

In regard to claim 21, Kumar et al. teach a dielectric material comprising fluorinated silica glass (Figure 20, column 5, lines 12-15).

In regard to claim 22, Kumar et al. teach a dielectric material comprising a silsesquioxane-based material (Figure 20, column 5, lines 12-16).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device structure as taught by Fornof et al. and the device having a dielectric material being at least 50% porous, and being over a conductive layer as taught by Avanzino et al. with the device having a dielectric material comprising a carbon-doped oxide, a fluorinated silica glass or a silsesquioxane-based material as taught by Kumar et al. to provide a device capable of effectively removing the unprotected area thereby forming vias 33 and 36 through the dielectric material (Figure 19-20, column 5, lines 52-57).

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

The following patents are cited to further show the state of the art with respect to the claims device structure:

Abell (US 2004/0121586 A1)	Albano et al. (US 2003/0054115 A1)
Cho et al. (5,847,443)	Gallagher et al. (US 6,596,467 B2)
He et al. (US 2004/0061231 A1)	Hedrick et al. (US 2003/0114013 A1)
Lopatin (US 6,387,818 B1)	Sharan (US 6,331,493 B1).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ida M. Soward whose telephone number is 571-272-

Art Unit: 2822

1845. The examiner can normally be reached on Monday - Thursday 6:30am to 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on 571-272-1852. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

IMS

April 1, 2005

John M. Soward
AU. 2822